DOCUMENT RESUME

ED 430 539 IR 019 568

AUTHOR Boyd, Sally
TITLE Computers in Classrooms.
INSTITUTION New Zealand Council for Educational Research, Wellington.
ISBN ISBN-1-877140-48-1
PUB DATE 1998-00-00
NOTE 42p.
PUB TYPE Reports - Research (143)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Case Studies; Computer Mediated Communication; Computer Software; *Computer Uses in Education; Cooperative Learning; Educational Administration; Educational Policy; *Educational Technology; Elementary Education; Faculty Development; Foreign Countries; Information Policy; *Information Technology; Policy Formation; Use Studies; World Wide Web
IDENTIFIERS New Zealand; *Technology Integration; Technology Plans; *Technology Utilization; Web Sites

ABSTRACT

This booklet outlines the information gained from five case studies in New Zealand primary schools on how the use of computers was integrated into the school environment and the curriculum. Principals, teachers, and information technology (IT) coordinators were interviewed about students' use of computers. Information on the equipment available and IT policies and plans at each school was collected, and students were observed as they used computer equipment. The following areas are discussed: (1) history of and visions for computer use; (2) the main aims of computer use; (3) management and costs; (4) plans and policies; (5) approaches to locating computer equipment; (6) the importance of technical support; (7) importance of staff development; (8) integration of computer use into the curriculum; (9) approaches to maximizing the use of computer equipment, including how/when students use computers, peer tutoring/group work, and guidelines; (10) use of software; (11) examples of how software is used (spreadsheets, presentation software, database software, drawing software, e-mail, World Wide Web, CD-ROMs, digital cameras/video images, school Web sites, other activities, and teacher use of computers); (12) benefits and advantages of computer use for students; and (13) issues concerning computer use; and (14) essential factors which supported computer use. References for teachers are appended. (AEF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 430 539

COMPUTERS IN CLASSROOMS

Sally Boyd

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

K.A. Pickens

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

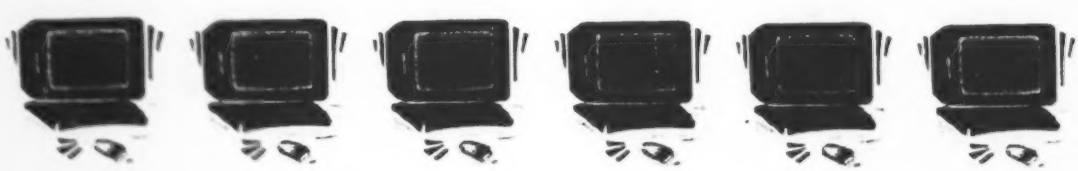
U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

New Zealand Council for Educational Research



IR019568

BEST COPY AVAILABLE

COMPUTERS

IN

CLASSROOMS

Sally Boyd

New Zealand Council for Educational Research
Wellington
1998

New Zealand Council for Educational Research
PO Box 3237
Wellington
New Zealand

© NZCER 1998

ISBN 1–877140–48–1

Distributed by NZCER Distribution Services
PO Box 3237
Wellington
New Zealand

ACKNOWLEDGMENTS

This booklet has been developed through the input of a number of people. Thanks for their participation are especially due to the principals, teachers, and students at Eketahuna, Featherston, Houghton Valley, Stokes Valley, and Tawa Schools.

CONTENTS

	Page
Acknowledgments	iii
Introduction	1
School Profiles	1
History of, and Visions for, Computer Use	4
The Main Aims of Computer Use	4
Management and Costs	6
Plans and Policies	6
Approaches to Locating Computer Equipment	11
The Importance of Technical Support	11
The Importance of Staff Development	12
Effective Professional Development	13
Less Effective Professional Development	14
Integration of Computer Use into the Curriculum	14
Approaches to Maximising the Use of Computer Equipment	15
How and When Students Used Computers	15
Peer Tutoring and Group Work	17
Guidelines	18
Use of Software	19
Examples of How Software Is Used	19
Word-Processing Software	19
Spreadsheet Software	22
Presentation Software	23
Database Software	24
Drawing Software	26
E-mail	26
World Wide Web	26
CD ROMs	27
Digital Camera and Video Images	27
School Websites	27
Other Activities	27
Teacher Use of Computers	28
Benefits and Advantages of Computer Use for Students	28
Issues Concerning Computer Use	30
Summary	32
Essential Factors Which Supported Computer Use in the Schools	32
Issues Concerning the Use of Computers in the Schools	34
References	35
Appendix – References for Teachers	36

COMPUTERS IN CLASSROOMS

Introduction

This booklet outlines the information gained from 5 case studies in New Zealand primary schools on how the use of computers was integrated into the school environment and the curriculum.

It is hoped that this booklet will provide you with ideas and information on ways to organise and use computer equipment in your school. A number of areas are described or summarised including:

- the computer equipment in each school,
- plans and policies concerning computer use,
- management systems set up to maximise the use of equipment,
- staff development,
- how the use of software was integrated into the curriculum,
- the benefits of using computers, and
- the factors which encouraged computer use in the schools.

This research focused on what is working for schools. Therefore, schools that were selected to participate already had in motion, or were in the process of setting up, computer programmes in which computer use was integrated throughout the whole school.

Principals, teachers who regularly used computers in the classroom, and information technology (IT) co-ordinators at each school were interviewed about students' use of computers at their school. Information on the equipment available and IT policies and plans at each school was collected. At each school students were observed as they used computer equipment.

This research was undertaken in June 1998. In total 5 interviews with principals, 17 interviews with teachers, and 26 classroom observations were conducted.

School Profiles

Profiles of the 5 schools are provided below. The description of hardware and software focuses on the equipment used by students. In addition to the equipment listed in the profiles, all schools had additional computers located in the administration area and the principal's office.

Eketahuna School

Eketahuna School is a small full primary with a decile rating of 5, located in a small rural Wairarapa town. This school has 12 computers (mostly MACPerformas, MacClassics, and Apple2Es), some with attached dot matrix or inkjet printers, located in classrooms. At Eketahuna School 5 computers are rotated among classes for 2-week periods. At other times the computers were spread around the school, mostly one or 2 to a classroom. Teachers could choose not to be part of the rotational system and have a computer permanently in their classroom.

One MACPerforma with access to the World Wide Web and e-mail, a scanner, and a printer are located in the library.

The software most frequently used at this school is:

- The ClarisWorks suite of word-processing, spreadsheet, drawing, and database software for class work;
- Hypercard and Hyperstudio;
- Logo for problem-solving;
- Color It for editing scanned pictures;
- Netscape for web browsing;
- CD ROMs such as the Sunshine Readers, Maths Made Easy, Maths Rabbit, Living Books, and ABC are used by younger children; older children use CD ROMs for research.

Students in all class levels at Eketahuna School use computers, although the school had a more extensive programme in place for middle and senior school students. Eketahuna School is in the process of maximising the use of its current equipment.

Tawa School

Tawa School is a large, full primary with a decile rating of 7, located in the outer Wellington suburbs. This school has a computer suite next to the library with 6 multimedia AppleMac computers connected to the Internet and a laser printer, at least one stand-alone computer in every classroom, 2 computers in the library, a scanner and digital camera located in different classrooms, computer equipment on trolleys which could be moved between classrooms, a number of printers in classrooms, and IT classes in the middle and senior school for which students purchased their own laptop computers.

The software most frequently used by students and teachers is:

- The ClarisWorks suite of word-processing, spreadsheet, drawing, and database software for class work;
- Presentation software for class work such as KidPix for younger students, and Hyperstudio for older students;
- ClarisWorks Homepage, WWWart, Webpainter for webpage design;
- Photoshop, Movie Maker, Color It, and Graphic Converter for manipulating images for class work and webpage design;
- A selection of CD ROMs such as Encarta;
- Netscape for Internet browsing and Eudora as an e-mail package.

Computers are used at all year levels at Tawa School, but due to the extensive use of laptops in the IT classes the major use was concentrated in the middle and senior schools.

Tawa School is in the process of connecting all classrooms to an Ethernet network with an aim of locating a multimedia computer in every classroom to provide students and teachers with access to a range of software, the Internet, and external and internal e-mail.

Stokes Valley School

Stokes Valley School is a mid-sized, contributing primary with a decile rating of 3, located in the Hutt Valley. This school has a computer suite with 6 Pentiums and 3 Acorn computers, access to the Internet, a laser printer, and a scanner. There are 4 stand-alone computers with attached printers (of varying types) located in classrooms, and 2 computers located in the library. This school also has 3 concept keyboards.

The software most frequently used at this school is:

- The Office suite including MSWord and MSWorks for word processing;
- Creative Writer II and Pendown for word processing;
- Powerpoint and Hyperstudio for class work and projects;
- Paint It for illustrations;
- Reading software such as Dangerous Creatures;
- CD ROMs such as Encarta and The Magic School Bus;
- Educational games such as The Logical Adventure of the Zoombinis for mathematics problem solving and language work;
- Netscape for Internet browsing and Eudora for e-mail.

Teachers have access to e-mail on one computer in the computer suite. Stokes Valley School has an immersion unit for Maori students, who use the computer suite with desktops designed in Maori.

At Stokes Valley School a roster for access to the computer suite was in operation for all middle school students. Students in the junior school use computers less frequently.

Stoke Valley School planned to participate in NetDay 1998. From this 2 network ports would be located in every classroom with a view to providing Internet access to students and the administration area.

Houghton Valley School

Houghton Valley School is a small contributing primary with a decile rating of 7, located in the outer Wellington suburbs.

This school has a computer (mostly Pentiums with CD ROM drives) and a printer located in every classroom (one classroom has 2 computers) and in the library. The school has a digital camera.

The software most frequently used is:

- The Office suite of MSWord for word processing, Excel for spreadsheets, and Powerpoint;
- Access database for older children and Pinpoint Junior for younger;
- Logo and The Logical Adventure of the Zoombinis for mathematics problem solving;
- CD ROMs such as Encarta, the Oxford University Dictionary, and the Magic School Bus for research;
- Sunshine Readers and Creative Writer II for younger children;
- 3D Movie Maker for manipulating images.

At Houghton Valley School the major use of computers was concentrated in the middle school. A development to increase the use of computers in the junior school is currently under way.

Houghton Valley School is in the process of setting up a computer suite in the library which will consist of a small number of computers and a server to which all classrooms will be networked. Students will be able to access information downloaded from the Internet on to the server and use e-mail. The school's learning line was not functioning owing to the construction under way in the library. When it was operating, Explorer was used for Internet browsing. Another focus at this school is consolidating the use of existing equipment across all year levels of the school.

Featherston School

Featherston School is a mid-sized, full primary with a decile rating of 3, located in a minor urban area in the Wairarapa.

This school has 16 computers (mostly Pentiums, although the school also had 8 Acorns) located in classrooms, and a centrally located laser printer. The middle and senior schools are networked to a central server with access to the Internet and e-mail. This school has a concept keyboard.

The software most frequently used at Featherston School is:

- The Office 97 suite of MSWord, Excel, Access, and Powerpoint software (Wordpad is also used for word processing);
- Explorer for Internet browsing and Pegasus for e-mail;
- CD ROMs for reading and mathematics.

The major use of computers is currently concentrated in the middle and senior school, although access for students in the junior school is being expanded.

Featherston School is in the process of networking the whole school and setting up a computer suite in the library with 3 Pentiums attached to a server and a CD ROM stack. The network was functioning in the senior and middle schools, and the junior school network was in the process of being set up. Once this plan was completed there would be 20 work stations in the school, including the 3 in the library.

History of, and Visions for, Computer Use

The drive for the use of computers in these 5 schools was initiated in the 1980s by the vision of one or 2 people who used Commodore, BBC, and Apple 2E computers. These people were usually past principals who were computer literate and keen to see schools embrace the use of computer technology.

Since the 1980s the amount of computer equipment at the schools had gradually increased. For all schools, computerising the administration area and the library was a priority. Some schools purchased equipment sold off by businesses, some used a hire purchase agreement and bought in bulk, and others leased equipment. At one school a system was set up to assist staff to buy their own computers. Another school took the opportunity provided by fire to set up a computer suite in the rebuilt area.

In all schools the present principal and other staff members had taken over and extended the initial vision for the use of computers in the school. The process of refining, and acting on, the vision was now shared among a greater number (but not all) of the staff at each school or was the responsibility of a committee. In the 2 schools with the greatest amount of computer use the responsibility for planning and organising this use was devolved to staff.

All 5 schools were in the process of setting up networks: some were at the initial stages of getting cables into classrooms via NetDay initiatives; others had a network partially set up and were working towards connecting to more sections of the school.

The Main Aims of Computer Use

Principals stated that their main aims for developing the use of computers in their school were:

- To provide children with **access** to computer technology and the world outside school:

> To provide access to computers for every child.

- To use computer technology as a **tool** to enhance learning.
- To prepare children for the **future**:

> The obvious aim is to prepare children for the future. It is a fact of life. Children will be disadvantaged if they don't have IT skills. Being in a low decile area—children don't have access at home.

- To use tools that were **relevant and motivating** for children:

> To support learning with resources that make sense to children.

Other aims were:

- To develop children's skills in areas such as communication and problem solving.
- To provide opportunities and motivation for children with special needs to participate in the mainstream:

> Previously children would have given up—this doesn't happen now with the IT programme. Children who have special needs use the computers a lot. They are the resident experts and pass on their skills to other children. For some this would be the first time in their life that they have shown others how to do things . . . it gives them kudos.

Principals and teachers had a variety of themes and philosophies underpinning their use of computers with students, the most commonly mentioned themes being:

- the use of computers increased the child-centred nature of classrooms, and associated with this was the development of peer tutoring systems;
- viewing computer software as a tool, and encouraging students to select the most appropriate tool for the task at hand;
- encouraging students to develop independence; and
- through the use of computers, assisting students to acquire a range of essential skills.

As one teacher said:

> My philosophy of teaching is still the same [when I use computers]— that is, children taking responsibility for their learning as much as possible. [To encourage children to] collaborate rather than compete —this works well with computer use as it promotes problem solving and collaborative approaches with students.

Management and Costs

The cost of setting up the current computer equipment varied between schools depending on the extent of their computer development. For the current setup in the 5 schools, costs ranged from approximately $25,000 to more than $110,000 for the purchase of hardware and software.

A variety of funding sources was utilised by schools. Most of the money for computer developments was raised outside the operation grant, though most principals used this grant as a source of some funding. The most common source of funding was community fund-raising. Two principals of schools with lower decile ratings found fund- raising in their community to be difficult. These principals opted to be directly funded to increase the money they had available and their flexibility in managing this money. Two schools used Telecom school connection money. One school offered to host websites as a way of raising funds. Another school was seeking sponsorship money.

Plans and Policies

All the schools had some form of computer plan or policy although these varied considerably between schools. Most of the plans or policies were developed by a committee or working group of interested staff and occasionally board of trustee (BoT) members. The policies were then presented to the BoT for ratification.

These policies and plans were more familiar to principals than they were to other staff. Policies appear to have been useful starting points to encourage computer use in the classroom, to assist staff to define how they were going to use computer equipment, and for long-term planning. But these policies were not necessarily a "living" document for all teachers.

Most schools had plans which covered the following areas:

- equipment purchases over a defined time span, usually of 3 to 4 years' duration;
- policies concerning computer use by students and teachers for the purpose of learning;
- responsibilities for organising IT developments; and
- plans for professional development.

For example, Houghton Valley School had a 4-year plan which outlined 6 components of an IT programme:

- an audit of current IT equipment,
- development of a policy for IT use in the classroom,
- development of a 3-year plan,
- fund-raising,
- development of a school-wide scheme outlining IT skill levels which matched year levels, and
- staff professional development.

The Houghton Valley School policy for IT use in the classroom is shown below.

Houghton Valley School
Information Technology Policy

Definition of Information Technology

Information technology is machines and processes used for gathering, manipulating, publishing and communicating information and ideas orally, textually, numerically and visually.

Rationale

The purpose of this policy is to provide a framework for the use of information technology across the curriculum and at all levels of Houghton Valley School, in a manner which allows students to enhance the effectiveness and efficiency of their learning and which will enable them to develop the requisite skills to participate in the information society.

Guidelines

Students' skills

Students will be introduced to a range of information technologies as they move through our school. The intention is for students to use information technology in order to gather, manipulate, publish and communicate information and ideas in the context of learning across the curriculum. We will develop and utilise a school wide scheme to facilitate the sequential development of skills in the use of information technology by students.

Access to information technology

We manage the school's information technology resources to ensure all students have the opportunity to develop skills in the use of information technology efficiently and effectively. All students across all achievement levels have equitable access to information technology. Strategies are also in place to ensure all students have equitable access to information technology within each class.

Evaluation

We will evaluate and record student achievement in the use of information technology with reference to our school wide scheme and the essential skills section of the New Zealand Curriculum Framework.

Curriculum development

The use of information technology is planned for and included in relevant units of work across all learning areas. Our school continuously explores new ways that information technology can be integrated into learning and teaching.

Teacher professional development

We are working towards a high standard of information technology literacy amongst the staff. Teacher development will be ongoing and time will be provided to allow teachers to practise new skills. We will provide internal systems for training staff and will utilise external advisers when required to assist with the pedagogical and technical use of information technology.

Equipment acquisition

The school intends to purchase new equipment until each class has fair and equitable access to information technology. We will replace all technologies as they become obsolete. We will seek advice and support to plan for the future in our purchase of technologies. We will continuously develop long and short term goals as to what information technologies we wish to use within the learning and teaching processes at Houghton Valley School.

Maintenance

We will make sure that time and finance are available for maintenance of information technology.

Budget

We will budget annually for equipment acquisition, maintenance, technical support and teacher development as well as the ongoing costs of using the technologies.

Houghton Valley School also produced a document outlining the IT skills and experiences they expected students to have at the school. This document included a list of skills which could be developed through the use of computers:

Students will have the following learning experiences:
At Year 1 there will be a greater degree of teacher direction and by Year 6 the students will be developing independent skills.

Gathering information	CD ROM, e-mail, Internet
Manipulating information	Database, spreadsheet
Publishing information	Desktop, multimedia
Communicating information	E-mail, Internet
Problem solving	Logo, interactive fiction
Computer-assisted learning	Talking books, CD ROM

Here is another example of a school's IT policy:

STOKES VALLEY SCHOOL
POLICY: INFORMATION TECHNOLOGY IN THE CLASSROOM

Review Date: September 2000

Rationale
To promote the use of information technology across the curriculum and at all levels of the school, in a manner which allows students to enhance the effectiveness and efficiency of their learning, and which will enable them to develop the requisite skills to participate fully in the information society.

Purposes
1 To promote the use of information technology across all learning areas.
2 To promote the use of information technology across all achievement levels.
3 To promote equity in the use of information technology.
4 To ensure that the use of IT equipment in the school is carefully monitored and legal.

Guidelines
1.1 Information technology will be used to enhance learning in all areas of the curriculum except physical education.
1.2 Information technology will be used by students and staff to gain access to, manipulate, publish and communicate information.
2.1 Information technology will be used by all students, irrespective of the class level or specialised needs they require.
2.2 Information technology will be used within other curriculum learning, not treated as a separate subject.
3.1 Time tabling and management of IT equipment will ensure equity of access for all students.
4.1 The school programmes will endeavour to develop skills which will enable students to be actively involved with IT in their everyday learning.
5.1 Only legally purchased and registered software will be used at this school.
5.2 Students will be clearly instructed in the appropriate use of IT equipment to minimise misuse and damage to expensive resources.
5.3 Wherever possible the school will purchase equipment that is at least contemporary and preferably leading edge technology.
5.4 The Board will maintain a five-year plan for information technology.

Tawa School had developed a 3-year plan, with an overall goal which stated that, "children and staff use IT to best support their learning". This plan outlined a series of objectives as well as strategies for achieving these objectives:

- developing an internal and external network,
- staff development to increase staff's competence and confidence in using IT,
- maintaining equipment,
- development of students' IT skills,
- the integration of IT into the curriculum,
- the management of IT developments by staff, and
- funding and sponsorship.

For example:

Objectives	Strategies
Staff are using IT in their classes with competence and confidence	• After school training sessions run by the IT team • Staff meetings—Term 1 of each year (for training—compulsory) • Quality learning circles in Term 1 • Staff attend conferences and courses • Staff attend Apple Education bus tour (2 staff per year) • Staff have in-class support and training • IT team support • Sharing sessions
An IT team is established at beginning of every year to lead IT in the school	• Communicating vision • Lead by example • Provide necessary support staff • Develop expertise in specific areas • Take responsibility for different areas • Up-skill team members • Regular review

Two schools had rosters for access to computer equipment, and one school was in the process of developing an acceptable-use policy for the Internet.

At some schools there was ongoing discussion about whether it was desirable to define and match computer skills to year levels and, if so, how this was to be done. Staff at Eketahuna School had developed a checklist for the computer skills to be mastered at different levels; this is shown below.

Computer Skills Checklist

School Record Book, Eketahuna School

Skills	Date Achieved
Level 1	
Become familiar with the keyboard	
Level 2	
Printing and saving procedures	
Editing procedures to achieve results	
Define logo procedures	
Making turtle move	
Logo	
Using data to produce graphs	
Setting up a table	
Spreadsheets	
Improving appearance of work	
Using spelling checker	
Correcting errors on screen	
Editing work on draft	
Printing drafts	
Composing on computer	
Word	
Delete files	
Save new files on hard drive and on disk	
Open and close files	
Start and quit programs	
Insert and eject disks	
Follow correct shut-down procedures	
Level 1 and 2 comments	

Skills	Date Achieved
Level 3	
Sending and receiving e-mail	
Starting Netscape	
Starting and quitting Internet	
Internet	
Operating HyperCard stacks	
HyperCard	
Locate information	
Operate database	
Database	
Level 3 comments	

Skills	Date Achieved
Level 4	
Very competent in all skills	
Word	
Printing stacks	
Using animation	
Linking cards	
Adding graphics and sound	
Pasting text from ClarisWorks	
Entering information in fields	
Adding/editing buttons/fields	
Using toolbox	
Creating/opening stacks	
HyperCard	
Printing text and graphics	
Saving text and graphics	
Locating information	
Internet	
Set up layouts	
Process and analyse data	
Collect and enter data	
Set up fields	
Database	
Level 4 comments	

Approaches to Locating Computer Equipment

At all 5 schools, in order to maximise the use of computers, equipment was located in at least 2 different sites depending on the facilities available at the school:

- Computers and printers permanently **located in classrooms**.
- Computers **located in a cluster** with an IT teacher available to work with students and staff for a proportion of the day. This cluster was usually located in or next to the library. This location allowed teachers to set some students tasks in the library while they worked with others on the computers.
- Computer equipment located on **movable trolleys**.
- Equipment, and skills in using that equipment, **spread around the school**, e.g., a scanner in one classroom, and a digital camera in another.
- A number of computers **rotated between classrooms** during the year.
- **Networked computers** (either in classrooms or centrally located) with shared access to facilities such as printers and CD ROMs.

In addition to the various ways of locating equipment listed above, students were able to search out equipment which was not being used in other classrooms.

All the schools in this study had or were working towards having some form of "computer suite", that is, a group of computers located in one area, as well as at least one computer in each classroom. Staff at some schools experimented with a variety of arrangements before they came to the conclusion that they needed a cluster of computers to best utilise the available equipment and teacher time.

Teachers in schools which did not yet have some form of computer suite commented that they would like to have this arrangement.

The Importance of Technical Support

One essential factor which helped to support the use of IT in the 5 schools was dedicating staff time to IT developments. Staff at all of the schools evolved creative and flexible systems for managing staff time to ensure that IT support was provided. These systems varied between schools depending on the nature of their computer programme and the finances available; for example, one principal of a low decile school said:

> The whole group of teachers are not using computers but that is okay. The school is organised around people strengths so that the children don't miss out. I see that this is the way of the future—that teachers who specialise will be able to spread their skills across more than one group of students. This is happening not just in IT but in Maori and music as well. The system is organised so the children are not disadvantaged if the teacher is not skilled in particular areas. Direct resourcing has given us this flexibility.

Four schools designated staff as IT co-ordinators. These staff members were released for a range of time periods during the year to set up new network systems, provide technical support, work with

children, and train other staff. The length of release time varied from 0.1 for a smaller school to 0.5 for a school with a more extensive programme. The school with the most extensive programme had a teacher released for half the year to set up new systems and work with children, another teacher released for 1½ hours a week to work with other staff, and 2 other teachers released for 1½ hours for further training. This extra teacher-release time was organised by allocating one or 2 extra children to all other classes to free up a teacher. In addition to this, 2 technicians were employed for a total of 3 hours a week.

The school which did not have a staff member released to focus on IT employed a task force green worker who came in every day to set up new systems. This worker also provided some technical support to teachers. In addition to this, the principal provided informal technical support. One other school used task force green workers in this capacity. Teacher aides were also utilised by some schools to work with students while they were using computers.

The Importance of Staff Development

The cost of staff development to support computer programmes varied between schools, although the amount was difficult to specify exactly given that the release time provided at some schools was also a form of staff development.

Of the total funds allocated to developing computer programmes, approximately 3–11 percent was spent directly on formal staff development and training by 4 schools. (This figure does not include the cost of teacher-release time for IT developments.)

Current and past principals at the 5 schools focused initially on getting computer equipment into their school, but then found that unless this was backed up by an extensive professional development programme the equipment was not used. Accordingly, training was organised at some schools; at other schools this was planned.

When looking at models of technology integration, Klaassen (1996) suggests schools can vary from investing more in a **soft** approach, i.e., in human resources such as teacher training, to investing more in a **hard** approach, i.e., in hardware and software. Other research has indicated that for IT programmes to be successful, investing in the hard approach should not be at the expense of the soft (Boyd, 1997; Gilmore, 1993).

All the teachers interviewed felt confident about using computers in the classroom. These teachers had some characteristics in common—they had used computers for a while at school and had access to a computer outside school which they had used for a number of years. Most teachers found that using a home computer was a starting point for developing their confidence and interest in using computers with students.

This highlights the importance of providing teachers with access to computers for their own use, and so they can develop confidence in using them with students.

The teachers interviewed received a wide range of formal and informal professional development and training. All teachers received training from at least 2 different sources including:

- *External courses and conferences*—Courses that provided a theoretical basis for using computers in the classroom or had an educational focus were the most common type of formal training attended by teachers, e.g., Massey or Otago university papers on computers in education or computer-mediated communication, LEA Infotech courses, or conferences on

the use of IT in education. Approximately half of the teachers had participated in external skills-based courses which did not necessarily have an education focus, e.g., attending MAC user-group meetings or training on slide shows, e-mail, word processing, databases, or spreadsheets.

- *Visiting consultants*—Two schools organised regular visits from consultants who were knowledgeable about the hardware and software used in the school as well as how to integrate the use of computers into the classroom programme. Eight teachers had participated in these sessions.
- *In-house support*—Most teachers received in-house training from staff such as principals, specialised IT teachers, technicians, and other teachers. In all schools, teachers informally assisted their colleagues, but in some schools this relationship was formalised, i.e., time was allocated for this purpose, staff meetings were organised for idea sharing, or buddy systems were initiated.
- *Friends, family, and students*—Some teachers received training from friends or family members, and 2 teachers indicated that the children at school showed them shortcuts.

Some teachers reported that they partially trained themselves—or they were the trainer and so had to teach themselves.

In all 5 schools, professional development which covered the whole school was provided or was planned. In the past some staff had participated in whole school training organised by an external provider. Principals were now moving towards providing whole-school sessions tailored to the equipment at their school and the needs of their staff, in an effort to increase computer usage. At some schools the provision of training was less formal, with IT teachers providing needs-focused sessions for others when they required it. Whole-school development was seen as a priority by some principals who noted that if only one or 2 staff were trained, this left the school in a difficult position when these staff left.

Effective Professional Development

The characteristics of effective professional development that teachers identified were that it:

- provided an opportunity for hands-on or practical experience—this was seen to be the most essential characteristic by the teachers interviewed,
- provided time to explore new hardware and software,
- provided tasks to try out with their students,
- provided follow-up sessions to discuss experiences,
- was for a short timeframe but on a regular basis,
- met the need they had at the time,
- provided time to share ideas with other teachers and trainers.

Some examples of the types of professional development teachers found useful were:

> I like practical hand-on training on a regular basis for a short period of time, e.g., one to 2 hours every week for a month. Going back to the same thing,

> refreshing what you have learnt, and building on skills. It is most helpful if I need help with issues—that's when I learn. When it is tailored to the need I have at the time . . . if tasks and practice [are set up].
>
> I learn more by trying to do it, then asking people for help. . . . Trying ideas then getting students' responses. Having people around to bounce ideas off and to give inspiration. Seeing other teachers' and students' work. . . . I like to see examples and be exposed to a whole lot of stuff. I like a starting point—if you don't know what's out there, how do you know what you want?
>
> The best training made me realise how easy it was. It had a lack of jargon and they explained all the basic Internet tips. It was hands-on, it was set up for a purpose, tailored for educational use, and was backed up with other activities that were not computer related. The best training fits into curriculum areas and into the classroom—a lot of training is geared towards business and isn't relevant.

Less Effective Professional Development

Approximately one-quarter of the teachers reported a number of areas (mostly the converse of what was effective professional development) to be less effective for them, that is:

- when there was no follow-up,
- if they didn't have the opportunity to try out the hardware or software that was discussed,
- if the sessions covered a large area in a short timeframe,
- if the sessions were longer than a couple of hours,
- if the trainers used complex jargon,
- if the professional development did not meet their immediate needs or was not relevant to what they were doing at the time,
- if the group being trained was large, or of widely varying skill levels.

For example:

> Big long courses with no follow-up or ongoing support organised. You need more support to set up [in the classroom]. Things can be too rushed. You need time to play and try things out.

Integration of Computer Use into the Curriculum

Principals planned to integrate computer use across all curriculum areas, and to eventually cover all year levels in the school, if this was not already the case:

> Computers used as a tool, integrated into the curriculum.

One principal commented:

> We would like to get to the stage where computers were part of the furniture.

Other schools were already at this stage and were developing students' planning skills so that they:

> Use the information technology which best supports learning.

Approximately two-thirds of the teachers interviewed were using computers throughout all areas of the curriculum to fit into a range of topics students were covering:

> I start with the topic related to the curriculum—I look at how computers support the learning objectives. Then ask "Is it [using computers] the best or is there a different way to show them how to do it?"

Teachers who integrated computer use throughout the curriculum tended to be those with permanent access to more than one computer. Teachers with less access to equipment found integration more difficult and therefore tended to focus on English or language work (such as story writing), mathematics, technology, science, and selected topic work:

> Mostly for topics, but not half as much as I would like to.

Approaches to Maximising the Use of Computer Equipment

How and When Students Used Computers

In all the schools visited most computers were in use nearly all the time (provided they were functioning!). Levels of access varied depending on the resources available, e.g., teachers of the laptop classes at Tawa School reported that they encouraged children to select the best method for the task at hand:

> Children use them when appropriate—some children have taken it on board more than others. Some children at the start use it for everything. By term 4 children choose the best tool (after the novelty wears off). We did more work on planning.

> [The children use computers] all the time. Some computers are in use 80 to 90 percent of the day. Some children do most of their work on the computer. We don't have a booking system for the classroom computer. The children work it out.

Teachers using computer suites tended to work with small groups of students:

> The seniors come to the computer centre in small groups for maths and language for approximately 3 weeks a term. While in the lab students work on activities both on and off the computers. On average students in these groups work on the computers every 2 to 3 days. Junior students, and other students including children with special needs, come in small groups to work in the lab. Teachers can request to send their children up to the lab as part of a work or behaviour contract, or to publish work.

> I take small groups from other classes. It could be a group of children, a group with a teacher, or a teacher by themselves. I train small groups to train other children. I also help other children out who come to the suite to do their project work.

The systems set up in schools with less access to equipment were managed differently by each teacher. A summary of some of these systems is outlined in the publication *Infotech and Educating* (LEA, 1996). Sometimes the system was set up by the teacher who set a task within a certain time period for children to complete. In general, one feature of these systems was that they were managed by students.

The way systems were managed tended to depend on the age of the children. Younger children were usually given defined tasks with a set time period. Some teachers felt that this gave the children a sense that access was equitable. Older children were encouraged to manage themselves and to elect to use the computer when appropriate for as long as they needed to complete the tasks which they had nominated:

> For younger children I had a rotation system at writing times to teach the little children skills. Older students book the suite and manage their own access and use.

The systems used in classrooms evolved over time. Most teachers who had used computers in school for a while started out defining systems and then made a transition towards more child-centred systems as they became more familiar with integrating computer use into their classroom programme:

> With language I have moved away from rotation—the children use the computer when they need to if it is free, or go on with something else till it is. I encourage them to work on projects before school if they need more time.

Some teachers found that they needed to give students with fewer keyboard skills more access:

> I have tried all sorts of methods and still found that some children get more access. Slow keyboarders need more time. I am trying grouping for slow/middle/fast. I give the slow ones more time. It depends on the activity they are doing and the time available.

In addition to using computers in their own classroom, students at all the schools had the flexibility to search out computers in other rooms which were not in use if they wished to publish work.

The systems most commonly used in the 5 schools were:

- *A checklist system:* A list of children's names was stuck on or near the computer. Students ticked their name when they completed the task they were doing and then found the next student on the list.

- *A single clothes-peg system:* This system is similar to the checklist, as one teacher described it:

> Each child gets a turn every 2 to 3 days for 15 minutes. There is a timer which the child turns on. We have a peg system. They move the peg on to the next name. The system is managed by the children.

- *A multi clothes-peg system:* This is similar to the single clothes-peg system except that students specify the software or task they are going to complete:

> We have a system with clothes-pegs—4 sets of tasks or different software. Each child goes on every 3 days or so for as long as they need the tool.

- *A grid booking system:* When students are ready to use a particular piece of software they book a time on a chart.
- *A general booking system:* In schools with a computer suite, students were able to book to use the computers with the IT teacher.
- *Free access:* In classes where students used laptops a couple of desktop computers were available for student use. Students organised their time on these computers.

Peer Tutoring and Group Work

In all of the schools students used computers independently, with peers, and with teachers. At most of the schools, students sometimes used computers in their own time, e.g., students used the Internet on a computer located in the library, or completed projects before school. Aside from teachers, students also used computers with a range of other people, i.e., teacher aides, employment service volunteers, IT co-ordinators, other teachers, parent helpers, and older or younger students.

At all 5 schools peer tutoring and group work were features of how computers were used by children. Peer tutoring systems took a number of forms:

- *Teacher-selected tutors:* Some teachers (usually those with more access to computer equipment) modelled skills to the whole class and then selected peer tutors to support other children when they were using these skills:

> To teach new skills I model first to the whole group but they won't all take it in. Then it depends what it is. Some children will work independently. For others I might get a group and talk them through it step by step. Once they know the skill, I use a lot of peer tutoring.

- *Self-selected tutors:* In other classrooms students select themselves as peer tutors:

> If it is learning time—a new skill. I will bring them to the suite to teach the skill then they can use it in class. I teach new skills to the whole class—experts select themselves and they help others.

- *Pyramid tutor system:* Some teachers with less access to equipment used a pyramid system to teach new skills to students—they taught 4 or 5 students who then were responsible for passing on these skills to other students and so on.
- *Single tutor system:* Some teachers trained one child on a task—this student then tutored anyone who did that particular task.
- *Rotating tutor system:* Some teachers selected a different set of peer tutors for different software or tasks so all children were given the opportunity to be the "expert".
- *Cross-age tutors:* Some teachers trained older students as troubleshooters and monitors who then assisted children in other classrooms when necessary. Other teachers "buddied up" their class with another so students could teach each other skills, or encouraged members of last year's class to train their present class on new skills.

Other features of these peer tutoring systems included a focus on:

- *Developing coaching skills:* Some teachers coached students on "computer manners" and peer tutoring strategies as they found that peer tutors were sometimes likely to take over the keyboard:

> We have a "hands behind back" system for peer tutoring.

- *Developing independence:* Teachers also trained students to ask a classmate, older student, or the school's IT co-ordinator before asking the teacher how to solve a problem:

> Having the children trained as tutors makes life just so much easier —they don't have to wait for me. They will go and get each other or the IT co-ordinator independently.

Guidelines

Teachers set a number of guidelines for students when they were working on computers. Some guidelines concerned respect for other students and the equipment:

> Routines need a lot more emphasis, thinking about what is in the space due to the laptops.
>
> You set the guidelines whatever they are, e.g., no food, no drink, and clean hands.

Other guidelines covered how to use the equipment, e.g., a flow diagram showing the steps to take from opening a file to saving, or a list of basic spelling words to assist students as they worked was placed on the wall near the computer.

At one school the students had a small notebook in which they recorded handy hints and shortcuts. At other schools simplified manuals for students to refer to as they worked on the computer were developed and placed by the computer.

Use of Software

At all the schools generic "tool" software was the most common type used by children in the older age group, e.g., word-processing, spreadsheet, database, presentation, and draw packages, e.g.:

- Word-processing software was used mostly for publishing language work; story, letter, and diary writing; editing work; developing newsletters; and project work in range of topics.
- Spreadsheet software was used mostly for mathematics, especially graphing in statistics.
- Drawing software was used for design and graphics for a range of class work.
- Database software was used for data collection for projects.
- Presentation software was used for projects, language, and topic work.
- Logo was used for mathematics (mostly geometry) and to develop problem-solving skills.
- CD ROMs were used for a variety of purposes including research for projects.
- E-mail was used for external communication, and to develop students' writing and communication skills.

Children tended to use software appropriate to their level. Younger children, and children with special needs, were more likely to use software tailored to their skill level such as interactive fiction, mathematics problem-solving games, presentation software such as KidPix, or assisted word-processing packages such as Creative Writer II. As they got older students used software such as MSWord and ClarisWorks for word processing, or Powerpoint as a presentation package.

Given that there were some differences in the software used by younger and older students at each school, principals and teachers at all the schools, either consciously or by default, were rationalising their use of software. Schools were working towards students using a standard set of core software so they could transfer their skills from one year level to the next. This standardisation was developed in some schools as teachers and principals observed an array of different types of software in classrooms, and therefore students passing from one year to the next were required to learn how to operate new types of software each year.

Examples of How Software is Used

This section of this booklet provides some examples of how students used the software available at their school, and the benefits teachers perceived this use to have. A list of websites and publications which provide resources and ideas about how to integrate the use of computers into the classroom is contained in the appendix.

Word-Processing Software

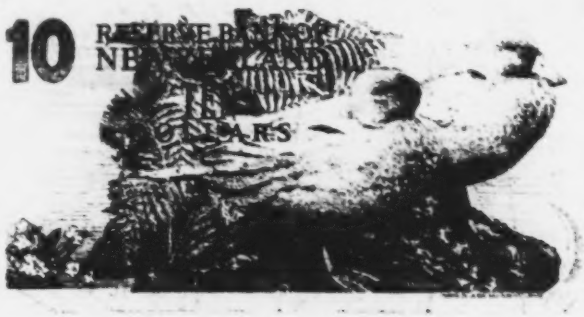
1. Word-processing software was used in all the schools for publishing a range of work across the curriculum. Many teachers found that when students used word-processing packages they were more willing to work on projects for a long period of time, more likely to write longer stories, and more likely to self-correct errors and insert punctuation as they could more clearly locate mistakes, either visually or through using spellcheck programs. Composing stories which were then saved afforded students a greater opportunity to rewrite and edit their work.

This is an example of a story a student wrote using a word-processing package. MSWord options were set up so that misspelt words were underlined in red, and inaccurate grammar was underlined in blue. First he selected the title from a clipart folder. He then composed his story. He used a large font size and centred text to enhance the presentation of his work, and the spellcheck to ensure that words were spelt correctly.

"All right" I said I had just looked in my piggy bank I had $35. I had a idea how to spend my money. I was thinking of going to the movies with Tom so I ran to the living room where my mum was doing a crossword. I said if it was O.K. with Tom's mum Mandy if we could go to the movies and she said "Yes" "WHOOO" I said and I raced to the phone. I rang up Tom and asked him if he could go to the movies with me. He asked his mum and she said "yes" we organise it and off we were me and Tom to the movies. Me and Tom were going to see Godzilla its about this huge dinosaur who came out of the sea and to New York city and thrashes buildings and squashes people and bites planes and helicopters and we thought it would be great movie. My mum dropped us off and we were here at last.

Word-processing software was also used:

- For brainstorming or "hot keying" ideas at the start of a topic.
- By teachers to develop worksheets on a range of topics; these could be completed by students online or printed out and completed by hand, e.g.:



How many different ways can you make $10?

1) $5 + $5 = $10,

2) $5 + $2 +$2 +$1 = $10,

3) $10 + $0 = $10,

4) 50C + 50C + $5 + $2 + $2 = $10,

5) $20 - $10 = $10,

6) $15 - $5 = $10

BEST COPY AVAILABLE

- By students who had difficulty writing and spelling, or for whom English was a second language. Some teachers found that assisted word-processing packages, such as Acorn Pages, were beneficial for these students. Such software allows the users to select whether they wanted the software to read back to them the letters, sounds, or sentences which they typed.
- By students who selected a clipart picture, then wrote a story about this picture. Teachers saw this as especially beneficial for students who had difficultly developing ideas to write about, or who did not have well-developed fine-motor skills for drawing and writing.
- By students to develop newsletters to send home. At Tawa School a group of students were observed working at lunchtime editing a newsletter on the upcoming junior disco.
- To show the connections between families of words. Teachers considered that the larger font size and layout helped students to see relationships, eg.:

Dot	**Cat**
Hot	**Hat**
Cot	**Mat**

- To keep weekly diaries. Diaries were used by one teacher to develop students' word-processing and language skills. The work completed on the diary was related to the work the class were doing on capitals and full stops.

Spreadsheet Software

Spreadsheet software was mostly used in mathematics in a number of ways:

- Formulae were used to demonstrate algebra concepts.
- Formulae were used for basic facts such as addition and multiplication.
- Spreadsheets were used to demonstrate series in mathematics, e.g., a teacher set up this worksheet using a spreadsheet:

0	2	4	6	8	10	12	14
0	-1	-2	-3	-4	-5	-6	-7
0	5	10	15	20	25	30	35
Now make your own sequential pattern.							

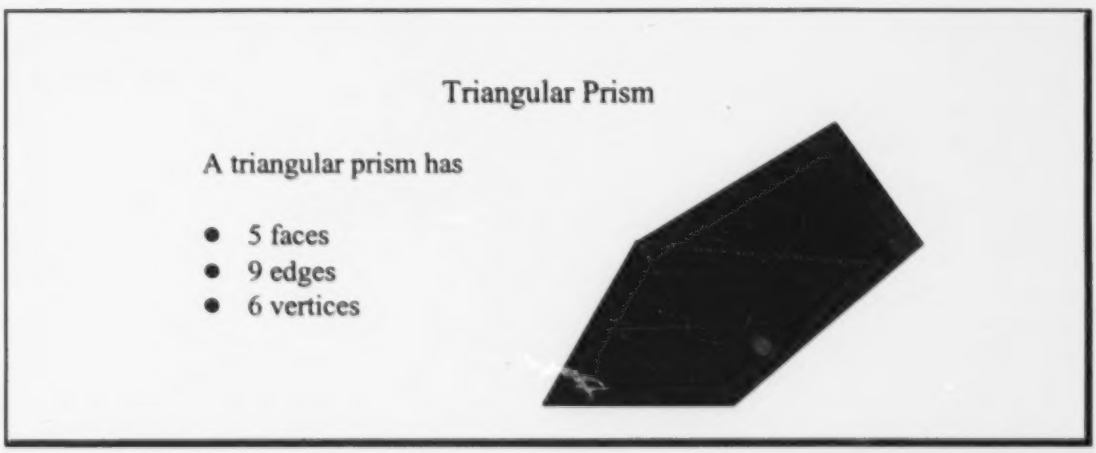
Students could look for the rule, and see what happened to the other series if they changed a number.

- Spreadsheets were used for graphing in a range of projects, e.g., at Tawa School one laptop class were observed collecting data on the heights of all the students in their class, sorting the data in order, using a formula to find the mean height, then graphing the data to see the shape of the distribution. Teachers commented that using spreadsheets to develop graphs saved time which was usually spent colouring in the graphs. Teachers also noted that students gained a greater understanding of how data could be manipulated as instant changes were visible.
- Spreadsheets were used for number patterns such as times tables. These patterns could be carried on into the millions, which was a task students could not achieve by hand.

Presentation Software

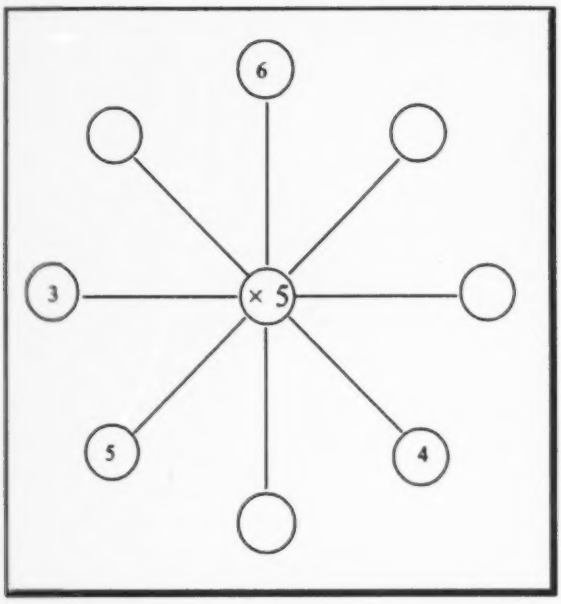
Presentation software was used across curriculum areas:

- At Stokes Valley School students used Powerpoint templates for a range of different projects. One template had sections for a heading, text, and a graphic. Students in the computer suite were observed completing a mathematics project using this template. Students worked in pairs (rotating turns) drawing 3-dimensional shapes using a draw package attached to Powerpoint. Using information from work they had previously completed, they typed a heading for each shape and information about the number of faces, edges, and vertices. Each pair of students completed approximately 6 slides on 6 shapes, e.g.:



Students helped each other, and other pairs of students, as well as calling on the IT teacher for assistance when required. At the end of the session each pair of students presented their slide show to the class by introducing themselves and then reading out the information on their slides. Students in the Maori immersion class went through a similar process to complete a project on volcanoes. Pictures of volcanoes were scanned into the computer. Students then selected these pictures and typed in Maori a title and information about the volcano.

- A couple of teachers set up slide shows and worksheets in mathematics on the computer for students to complete on topics such as basic facts, estimation, and rotation, e.g., students answered a basic fact question before the answer appeared in a box (the teacher had set the time delay for the answer to appear):



- Presentation software was also used for story writing, especially with students who found it difficult to generate ideas. Pictures were scanned into the computer, and students wrote stories about these pictures.
- Students used presentation software to make their own books, which were then printed, placed in clear file pages, and used as reading resources.
- Slide shows were developed by students to provide visual representations or animations of topics such as the digestive system and wind pollen.

Database Software

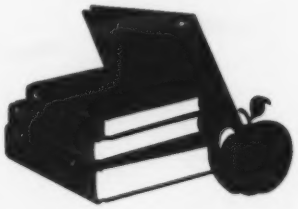
Database software was used for:

- Designing survey forms for mathematics projects, e.g., on questions such as "What is the hair washing behaviour of children in our classroom?" or, "What is your favourite subject?":

  The form below was designed using Pinpoint Junior. It was then printed and used as a questionnaire. All students completed the form, then the results were entered into the database and summary statistics were produced. Students then wrote statements about these statistics.

What is Your Favourite Subject?

What is Your Favourite Subject?



- ☐ Maths
- ☐ Silent reading
- ☐ Journal writing
- ☐ Taha Maori
- ☐ P.E.
- ☐ Art
- ☐ Technology
- ☐ Music
- ☐ Cooking
- ☐ Handwriting
- ☐ Spelling

- At Houghton Valley School students decided that they could automate the system for school lunches. They designed an order form and were working on a system of collating this information so that time could be saved ordering lunches and giving out change:

Lunch Order Form

Name _____ Class _____

Pies $1.80
- ☐ Mince
- ☐ Steak
- ☐ Steak & cheese
- ☐ Chicken

Ham Roll $1.90
- ☐ Yes
- ☐ No

Donuts $1.10
- ☐ Yes
- ☐ No

Iced Muesli Bar $1.50
- ☐ Carob
- ☐ Apricot

Zap Milk $1.20
- ☐ Strawberry
- ☐ Chocolate

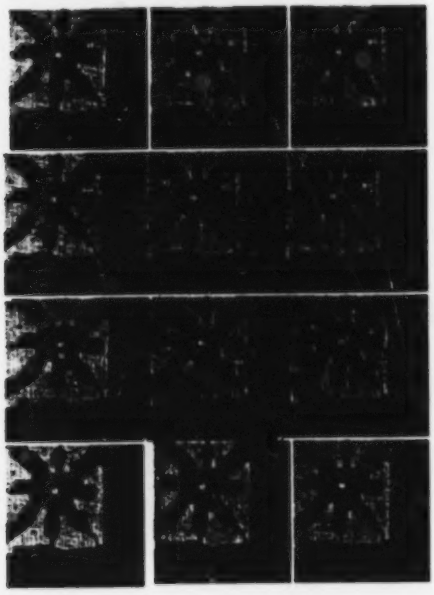
Nut Ota Bar $1.10
- ☐ Yes
- ☐ No

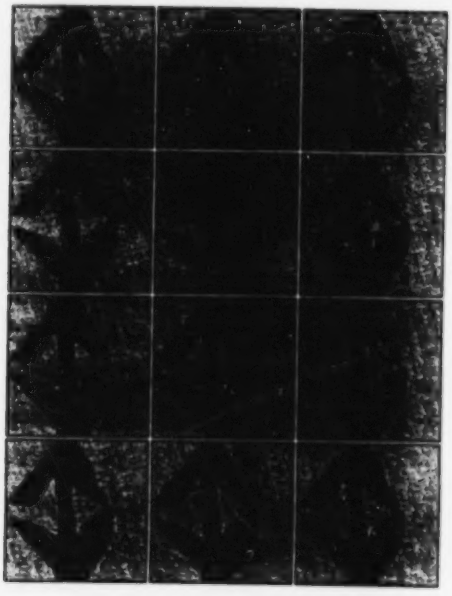
Just Juice $1.25
- ☐ Orange
- ☐ Tropical
- ☐ Orange & Mango

Milo $1.50
- ☐ Yes
- ☐ No

Drawing Software

Drawing software was used for illustrations for a range of projects, e.g., students were observed working on a repeating-patterns exercise in algebra. Each student designed a pattern based on ideas taken from books on Pacific Islands art. These patterns were then copied into a word-processing package and presented on the page:





E-mail

A few students were using e-mail to:

- Contact penpals and ex-teachers in other countries. At Featherston School all students had their own e-mail addresses (and another school was setting up a similar system). At Featherston School one class of students e-mailed an ex-teacher and followed him around the globe on his world trip.
- Contact people in industry for information on projects. Teachers reported that students appreciated the immediacy of replies. The accessibility of e-mail was seen to be especially beneficial for schools which did not have access to a large school library or a nearby public library. Teachers found using e-mail was a quick and affordable way to get information from overseas.
- At Tawa School students e-mailed replies to students and teachers at other schools who contacted them with queries about their school website and with answers to the maths challenge questions on this site.

World Wide Web

The World Wide Web was used as an alternative source of information by students who were researching projects. Teachers assisted students to complete searches by encouraging them to plan

their search and select the keywords they would use before they accessed the World Wide Web. Students also learnt how to refine searches.

CD ROMs

- The Encarta CD ROM was used at all schools for research on projects. Teachers worked with students on planning research and developing keyword lists to assist students to use Encarta.
- CD ROMs were used to give children experiences they would normally not have locally, e.g., at Eketahuna School students listened to the sounds of different instruments and an orchestra playing which tied in with a school production and music lessons.
- CD ROMs such as the Magic School Bus on the planets was used as an additional resource for topic studies. Information from the CD ROM provided a visual representation of ideas discussed in class.

Digital Camera and Video Images

- A digital camera was used to take pictures of school activities for webpages, school newsletters, and to give students pictures to insert in the stories they were writing, e.g., at one school a picture of students working in the new library was loaded into the computer and students then used this picture in an article they were writing for the school newsletter.
- Students with special needs used images, taken with a digital camera, as a basis for story writing.
- At Tawa School a video of the school camp was loaded into the computer. Then students used images from this video, and sounds they recorded to create "pick a path" stories in Hyperstudio.

School Websites

- At Featherston School students wrote items for the school's website which were uploaded by the school's IT person.
- At Tawa School each class was responsible for its section of the website. Students learnt to use the Internet by browsing the school website. In small groups they reviewed what was on their class webpage, discussed what they were currently doing in class, planned an update, and then designed it with the assistance of an IT teacher.

Other Activities

- Mathematics and spelling games were used as an activity within the classroom programme to reinforce skills, and to encourage the development of problem-solving, computer operation, and motor skills.
- Interactive fiction was used by younger students and students with special needs as a reading activity and to teach motor skills.
- Teachers designed desktops that suited students' ages and needs, e.g., at Stokes Valley School a desktop in Maori was designed for students in the immersion unit. At Tawa School, an online

flowchart was designed which followed the path students took from the desktop to saving a file, e.g., when students clicked on a picture of a pencil, a word-processing package opened with an automatically selected large font.

- Logo was used to teach geometry and to develop students' problem-solving skills. Teachers considered that students learnt a greater appreciation of the meaning of angles through programming the logo turtle.

Teacher Use of Computers

All but 2 of the teachers interviewed used computers outside class time for lesson planning, resource development, and administration:

> I do all my planning and monitoring such as record files for reports and assessments on my powerbook. I word process tests. I had to play a lot to learn how to use the software myself. Having my powerbook was essential.
>
> I use [the Internet] for researching topics. I use [word processing] for marking sheets, letters home to parents, and for class profiles. I have a database of addresses.
>
> I have a computer at home. I think I have forgotten how to write! I make banners, worksheets, and co-operative art backgrounds for classroom decorations.

A number of computerised administration developments were under way in the 5 schools, e.g., recording assessment data on a central system, developing templates for lesson planning, and developing a database of student information such as addresses, medical conditions, etc.

Benefits and Advantages of Computer Use for Students

All but one of the teachers, and all the principals interviewed, thought that children benefited from the use of computers at school:

> I see huge benefits in children teaching other children how to use the computer. They get pride and a sense of power. They can produce something of high quality, and get a great deal of success from it. This increases self-esteem and gives them a huge confidence boost.
>
> It provides a level playing field for children who can't spell.
>
> They learn not to be scared [of new activities], leadership skills, getting the hang of how computers work, how to pick up pieces of new software and transfer their skills, and planning and creative thinking skills for the workforce.

Teachers and principals were asked to indicate, from a list, what skills and benefits they thought students were acquiring from the use of computers. The benefits and skills mentioned most were:

- general enjoyment,
- general computer operation skills,
- written, oral, and visual language skills,
- communication skills,
- self-esteem and confidence,
- cognitive skills,
- concentration and motivation,
- social and group work skills,
- self-management and independence skills,
- information-gathering skills,
- presentation skills,
- mathematics skills,
- problem-solving skills,
- motor skills/co-ordination, and
- work and study skills.

An area of benefit which became increasingly apparent from the interviews with teachers was how the use of computers facilitated students' development of essential skills:

> Students learn a range of essential skills for accessing and working with information, e.g., IT skills. Lots of other essential learning skills are encouraged or reinforced naturally [through the use of computers].

Most teachers also noticed changes in some students' behaviour when they worked on computers. The most commonly mentioned change was an increase in motivation:

> Some kids hate everything bar the computer—it is easy for them to control and they don't have to write to create. It helps them to express themselves.

Other changes noted by teachers included increased concentration and self-esteem, and general behaviour improvements:

> We had a child who was disruptive. He was really keen to work on his project before school. We learnt how to scan together. He did a lot of work to get it finished in his own time and his parents came in to have a look.

Other general advantages of the use of computers reported by teachers were preparing children for the "real world" in the future, and providing students with increased access to the world outside the school:

> They're so proud of the things they do. [The increase in] self-esteem is marvellous. Computer skills are ESSENTIAL for the future.

> Giving the children access to information they wouldn't be able to access otherwise in an easy visual form. Even though we are a little rural school we can connect to anywhere in the world. We are not any different from being in the city.

Another area mentioned frequently by teachers was that students, through their use of computers, felt more able to take risks and try out new situations:

> They learn willingness to take risks and have a try.

Many of the benefits of computer use given by teachers and principals are also mentioned in other research in this area, e.g., that the use of computers can assist students to develop social and group work skills (Lai, 1992), help students with special needs to overcome communication barriers and provide more control over learning (Ryba & Selby, 1995), and assist students to develop information-gathering, presentation, and report-writing skills (Boyd, 1997).

Issues Concerning Computer Use

There were 3 major factors mentioned by teachers which inhibited their ability to fully integrate computer use into the classroom. The first factor was the cost, and therefore the lack of equipment available in schools; the second factor was a lack of time to fully explore the potential of software for use in the classroom; and the third factor was equipment breaking down and general technical issues. The current concern in 3 of the schools was setting up a functioning network. Teachers also identified some general issues in relation to students' use of computers. Ways to solve some of these concerns were also identified. These issues are expanded on below.

- *A lack of equipment:* Because of the cost of equipment, teachers did not have as much access to computers as they would have ideally liked. Systems to maximise the use of existing equipment had been developed to partially solve this concern.
- *Finding the time to experiment:* A major concern for nearly all the teachers interviewed, which inhibited their ability to fully utilise computers in the classroom, was finding the time to experiment with hardware and software before using it in the classroom. Providing teachers with access to computers, and release time to experiment, were ways of overcoming this issue.
- *Equipment breakdowns:* The major problem for nearly all teachers when using computer equipment was dealing with breakdowns. Printers and new networks were the biggest sources of concern. At most of the schools technical support people were employed or teachers were released to solve technical problems.
- *Appropriate professional development:* Being provided with professional development that suited their needs was a concern for some teachers. At all the schools principals were working towards providing professional development for staff via a number of different avenues, the most common being providing an on-site IT co-ordinator to support and train other staff, providing whole-school sessions on the school equipment, contracting consultants to work with teachers at school, and encouraging teachers to attend external professional development courses.
- *Central resourcing:* Many teachers and 4 of the principals would like more central guidance concerning computer use in schools as they considered that this was a relatively new growth area for schools. This guidance could take a variety of forms, but more direction and

suggestions about the use of software for educational purposes was a major component. Many teachers would like to know what was happening at other schools.

- *Software that was too complex for young students:* Teachers commented that software needed to be appropriate for the age group using it. Some teachers used less complex software with younger children, e.g., KidPix as a presentation package or Pinpoint Junior for database work.
- *Developing students' keyboarding and software operation skills:* If there was only one computer in the classroom, developing students' keyboard skills was a concern for some teachers. Systems were set up to maximise the use of equipment and teachers found a number of other ways to encourage the development of skills. In most classrooms, computers were in use constantly and students took time out from other work to complete the tasks they were doing using the computer. Teachers produced instruction booklets to assist students and trained peer tutors. Most teachers encouraged students to use computers in other classrooms, and outside school hours. Some teachers set up exercises so that students were editing and spellchecking work in pretyped files to teach students basic skills with the software.
- *Teaching computer skills to the whole class:* Most teachers found it more beneficial to work with a small group of students using computers than the whole class, or to use peer tutors to teach skills.
- *Presentation v. content:* Some teachers found children could get distracted by the tool and not focus on the task. Teachers prompted children to find a balance between presentation and content and concentrated on teaching students to summarise information so they did not cut and paste from webpages and CD ROMs.
- *Limiting access to a set time period:* Some teachers found that having a set period of time for students to work on the computer was frustrating for students and so changed systems to allow students to work until they had finished a task.
- *The place of educational games:* Most teachers thought that educational games were one activity which could fit into the classroom programme as a whole but were careful not to give games too much emphasis. Some teachers used mathematics and spelling games as a way of familiarising students with computer use.
- *Using word-processing software as a typewriter:* Teachers varied on their views on students' publishing stories they had already written by hand. Some teachers considered it important that students composed their stories directly on the computer and used editing tools to refine their work (though this was more possible at schools with more than one computer per classroom). Other teachers considered that children benefited by typing in stories they had already written, as teachers observed a higher rate of self-correction.
- *Time use:* Computer use which was not purposeful was an issue for some teachers, e.g., students browsing the World Wide Web without planning a search first. This issue was overcome in a number of ways. Some set up systems so that students discussed what they planned to do before they accessed the World Wide Web or published work. Other teachers focused on developing students' skills so the first part of any activity was a planning session on how that activity would be completed and what resources would be used. Teachers

modelled this system to their classes. Other teachers used a booking system, which required students to state for what purpose they would be using the computer.

- *Classroom management:* Some teachers found that students would argue over access to computers. Some teachers developed, or encouraged students to develop, systems to ensure that access was equitable. At some schools "computer manners" were emphasised, i.e., access was removed if students did not respect the equipment or other students.

Some of the other concerns reported by teachers and principals included the need for more:

- software in general or knowledge about software,
- software related to the curriculum, e.g., beginning school maths,
- Maori-language software,
- staff confidence in, and commitment to, using computers,
- teacher laptops,
- professional development, and
- technical support.

Children isolating themselves if they worked individually on computers and high staff turnover were other concerns mentioned by teachers and principals.

Although all the teachers interviewed sometimes had problems with the use of computers, over all they considered that the advantages outweighed the disadvantages, and were enthusiastic about the potential benefits for students.

Summary

In all 5 schools computers were used across all class levels and in a range of curriculum areas, although usage was concentrated in the middle and senior schools and for work in language, mathematics, and selected topics. The degree of integration of computer use into the curriculum depended to a large extend on the computer resources available at the school.

A number of IT initiatives were under way at the 5 schools. At 4 schools a network was being set up to link classrooms to each other and provide greater access to the Internet. At all schools there were systems or plans in development to consolidate teachers' skills with existing hardware and software by the provision of formal or informal in-house professional development.

In all schools, innovative systems were evolving which suited the needs of the school, and which allowed for the sharing of scarce resources. These scarce resources were school funds, equipment, and teacher time and expertise. The systems set up ensured that these resources were maximised.

Essential Factors Which Supported Computer Use in the Schools

From this research a number of factors which assist the integration of computer use into the curriculum at these schools were identified. These were:

- **Securing release time** for an IT co-ordinator to provide on-site training for students and teachers as well as technical support:

> The main factor is having designated staffing. We would have never got past base one without this conscious decision— getting people to support the programme—that's the key.

- Having more than one staff member knowledgeable about hardware, software, and how to integrate the use of computers into class programmes, and a **core set of staff** who were committed to actioning computer policies and plans.
- Having **systems** which maximised the use of existing equipment, such as rosters for rotation of equipment or students, booking systems, or students using equipment in other classrooms or a computer suite.
- Having a **collaborative school culture** in which teachers shared their skills and ideas with other teachers.

> Everyone has a say. Just because you are a scale A teacher doesn't mean that you can't get into it.

- Providing **leadership** (at least at the initial stages) for computer initiatives. Once programmes have been running for a while, leadership of initiatives was transferred to staff.

> We were involved in developing the vision, so we model what is in it.

- Providing staff with **access** to computer equipment for lesson planning and administration (for teachers in this study this access was usually a home computer).
- Providing relatively **up-to-date equipment.**
- Rationalising software so that a **standard set of "tool" software** is used which includes word-processing, spreadsheet, database, drawing, and presentation packages.
- Providing a **cluster of at least 3 multimedia computers** located together near or in the library, as well as computers located in all classrooms.
- Prioritising **professional development** as well as the purchasing of equipment. Providing in-house whole-school training tailored to the equipment available and the needs of staff.
- Using formal and informal **peer tutoring** systems for students and staff. Related to this is a change to a more student-centred approach to teaching.

The systems set up to allow students access to computer equipment, and to provide teachers with expertise in using that equipment, varied between schools. Klaassen (1996) identifies 2 models of successful IT integration in schools. One model is to have a jointly developed and shared vision for the use of technology by all staff and the BoT. The second model is to locate IT equipment and skilled people in one area, e.g., the library. Both these models were in operation in the schools visited for this research. The 2 schools which made the most use of technology used a combination of the 2 models.

All but one of the teachers and principals interviewed for this research thought that the use of computers was beneficial for students, and were enthusiastic about the possibilities for students.

All listed a wide range of benefits and skills students acquired through the use of computers. The most common benefits mentioned were general enjoyment of activities by students, and students' acquisition of computer operation, language, and communication skills. In general teachers and principals indicated that the use of computers increased students' motivation and facilitated their acquisition of a range of essential skills. As one teacher said:

> There is a very high level of motivation for most students using computers. For some it is the presentation they can achieve— especially for those who have poor writing skills. They can do a research project and it looks fantastic.

Issues Concerning the Use of Computers in the Schools

There were a number of factors mentioned by teachers which inhibited their ability to fully integrate computer use into the classroom. Access to more equipment and time to experiment with that equipment as well as access to training and technical support were issues for some teachers and principals in all 5 schools. The issues most often raised by teachers and principals concerning the use of computer equipment were:

- Funding for more equipment and professional development on software and hardware was a concern for most of those interviewed; this was especially the case for teachers and principals in schools with lower decile ratings.
- Finding the time to experiment with software and hardware, and to research how it could be used within the classroom programme.
- The provision of extra technical support at school. Teachers indicated that they wanted to be "teachers and not technicians", although they often found themselves acting in both roles as they dealt with technical problems, printer crashes, and tried to set up a functioning network.
- Many teachers and 4 of the principals would like more central guidance or resources, especially about the use of software for educational purposes.

The experiences of teachers and principals in the schools participating in this research support some of the suggestions outlined by ITAG (1998). One of these is the need for schools to have increased access to technical and pedagogical support. The schools in this research appear to be following business trends in the use of computers, i.e., providing staff with access to tool-based software and an internal and/or external networking system. Business users, however, are often better resourced and have more access to technical support.

This research indicates that staff in schools make more effective use of computer equipment if on-site support and professional development are provided. This research also affirms other findings on the importance of an emphasis on professional development as well as on the provision of equipment (Boyd, 1997; Gilmore, 1993). Professional development and support could be provided via a cluster system as suggested in the ITAG report or through the provision of teacher-release time for this purpose.

The information gained from teachers and principals during the course of this research also supports some of the recommendations suggested by ITAG, e.g., that more centralised support is needed such as a help-desk, curriculum resources, and advice on software.

In summary it seems that for these schools, having the vision, the interest, and the flexibility to develop and adapt a system for computer use was vital to encourage the integration of computers into the classroom programme. These systems:

- suited the equipment available and the needs of the staff at the time;
- provided students and teachers with access to, and training on, the equipment; and
- were supported by trained staff and allocated time.

References

Boyd, S. (1997). *Learning by Bytes: Computers in the Classroom*. Wellington: New Zealand Council for Educational Research.

Gilmore, A. (1993). I've had the training: What now? *Computers in New Zealand Schools, 5*(1), pp. 16–23.

ITAG. (1998). *ImpacT 2001 strategies for learning with information technology in schools.* A submission to the New Zealand Government by the Ministry for Information Technology's IT Advisory Group. Wellington: ITAG.

Klaassen, C. (1996). *Successful change management for integrating computer technology into schools*. Unpublished MEd. (Admin) thesis, University of Auckland.

Lai, K-W. (1992). Computers in education: A learner-centred approach. In K-W. Lai & B. McMillan (Eds.), *Learning with computers: Issues and applications in New Zealand*. Palmerston North: Dunmore Press.

Ryba, K., & Selby, L. (1995). Empowering learners with computers. In D. Fraser, R. Moltzen, & K. Ryba (Eds.), *Learners with special needs in Aotearoa/New Zealand*. Palmerston North: Dunmore Press.

Appendix

References for Teachers

Webpages

Antarctica New Zealand site—science activities.
http://www.antarcticanz.govt.nz

Assessment resource banks—assessment materials, designed for the NZ curriculum, in mathematics, science, and English.
http://www.nzcer.org.nz

New Zealand Education Web—links to NZ school home pages and resources.
http://www.cwa.co.nz

New Zealand Sunsite—information about networking for NZ schools.
http://www.sunsite.net.nz

Schools online science pages—ideas for science projects using spreadsheets.
http://www.shu.ac.uk/schools/sci/sol/contents.htm

Teachers@work—contains reviews of 1000 plus sites of interest to NZ teachers.
http://www.teachers.work.co.nz

The International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS). These standards include examples of how technology can be integrated into the classroom programme.
http://cnets.iste.org

Unitec English online website—resources for teachers.
http://www.english.unitecnology.ac.nz

Books and publications

Lai, K-W. (Ed.) (1996). *Words have wings: Teaching and learning with computer networks*. Dunedin: University of Otago Press.

LEA. (1996). *Infotech and educating*. Wellington: LEA (NZ) Ltd.

The journal *Computers in New Zealand Schools* produced by the University of Otago Press.